Cosmic Love: Space Storm as a Dynamical Phase Transition

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Abstract:
The naked eye perceives space as a never ending darkness. Hopeful pinpricks of light sparkle out of the void, and our own sun appears as a tranquil sphere of light. In reality, the atmosphere of the sun is dynamic and whips out to strike the earth as it passes by in its orbit. Our solar system has the cosmic equivalent of wind, clouds, storms, and hurricanes called space weather. The most prominent space weather events are called space storms. Space storms are dramatic changes in our solar-terrestrial system that originate from explosions on the sun. When a storm affects the earth, there are no signs such as a shaking of the ground, but there are spectacular changes in the electromagnetic conditions around the earth as its magnetic field lines are twisted and shaken more than usual by the buffeting of the solar-wind, and auroral conditions can be extreme. In this talk I will present evidence that storm onset can be characterized in terms of nonequilibrium dynamical phase transitions. Initial results show that a dynamical transition in solar wind VBs is correlated with the storm onset for intense storms, suggesting that the transition observed in ground-based data is of external solar wind origin, rather than internal magnetospheric origin. On the other hand, some results show a dynamical transition in solar wind scaling exponents not matched in ground data. For smaller storms there is a strong dynamical transition observed in ground data without similar changes in the VBs scaling statistics. The results for small storms seem to reduce the importance of the solar wind fluctuations but the evidence for the intense storms seems to point to the solar wind as being responsible for providing the scale free properties in the DST fluctuations.